LXXIII.—*On the Caudal Fin of the* Clupeidæ, *and on the Teleostean Urostyle.* By C. Tate Regan, M.A.

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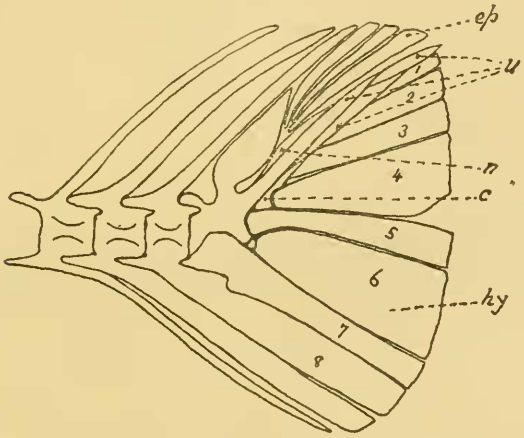
It is generally recognized that the Clupeidæ are closely related to the Elopidæ, differing from them only in a few features of specialization; consequently a knowledge of the structure of the latter family is essential to an understanding of the anatomical features of the former.

When I wrote an account of the skeleton of the caudal fin of the Elopidæ (*supra*, p. 354) it did not occur to me that there could be any question as to the homologies of the elements which I described with those of the Clupeidæ; however, Mr. Whitehouse's note in the last number of the 'Annals' has shown me that I was mistaken, and I therefore supplement my former paper with a description of the caudal fin skeleton of the Clupeidæ, selecting for illustration that of *Chatoessus erebi*.

Fig. 1.



Skeleton of caudal fin of *Chatoessus erebi*.

ep, epaxial basalia (epurals); *u*, uroneurals; *c*, last centrum; *n*, plate representing neural arches of upturned centra; *hy*, hypurals.

If the figure here given be compared with that of *Elops* (p. 355) it will be seen that in both there is a series of three epaxial basalia or epurals (*ep*) and that the hypurals (*hy*) correspond well enough, the main difference being that in

Chatoessus there are only four supporting the upper lobe of the fin, whereas there are five in *Elops*. The third hypural of the lower lobe (marked 7 in the figure of *Chatoessus*) is in each case attached to a centrum, to which there is also united a pair of elements which I term "anterior uroneurals," the union being by suture in *Elops* and by ankylosis in *Chatoessus*; these anterior uroneurals are strong bones, directed upwards and backwards, and can be readily separated from each other right down to their junction with the centrum; they embrace a laminar bone, the paired nature of which is sometimes evident, and which represents, in my opinion, the neural arches of centra behind the one which bears the anterior uroneurals; to the posterior edge of the anterior uroneurals is attached a second pair of bones, posterior uroneurals, and a third smaller distal pair is also present in both genera. In *Elops* the uppermost hypural of the lower caudal lobe is attached to the centrum behind that which bears the anterior uroneurals; in *Chatoessus* this hypural (marked 5 in the figure) has probably ankylosed with its centrum, which is not present as a separate element. The next hypural (4) is articulated with the last centrum in *Elops*, and in *Chatoessus* with a small median element (*c*) which obviously represents the last centrum; this sends up a spur-like process on each side of the base of the hypural above it, these processes corresponding to similar prolongations of the last centrum in *Elops*, protecting the sides of the notochord and concealed beneath the posterior uroneurals.

Other Clupeidæ do not differ very much from *Chatoessus*; the last centrum may not be recognizable as a distinct element, and the epurals may be reduced in number to two, but on the whole the variation is comparatively unimportant.

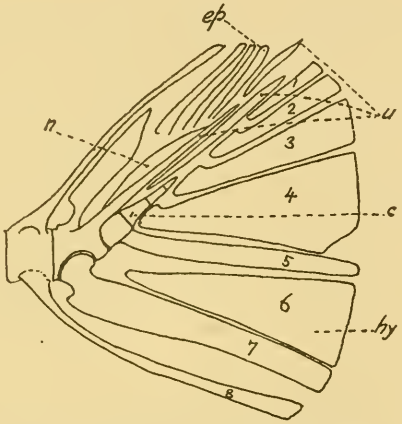
A detailed comparison shows that the Clupeidæ differ from the Elopidæ in

(1) ankylosis of the neural and hæmal arches with the centra;
(2) ankylosis of the anterior uroneural with the third last centrum;
(3) disappearance of the penultimate centrum as a separate element;
(4) reduction or abortion of the last centrum;
(5) reduction in number of the hypurals of the upper caudal lobe from five to four.

Thanks to the courtesy of Mr. E. T. Newton I am able to give a figure of the caudal fin skeleton of a young *Clupea*, which he has already described and figured (Journ. Quekett Micr. Club, (2) i. 1882, p. 82, pl. iii. fig. 1). I have nothing

to add to Mr. Newton's very full and accurate description but as his figure does not show quite clearly the precise limits of the uroneurals I have made another drawing (fig. 2). The principal differences from the adult *Chatoessus* are that the uroneurals are more slender, the penultimate centrum is distinct from the fifth hypural, and the last centrum is segmented into three, clearly showing that the paired posterior processes already described represent two incomplete centra.

Fig. 2.



Skeleton of caudal fin of a young *Clupea*.
Lettering as in Fig. 1.

The name "urostyle" has not usually been applied to any of the pairs of bones (uroneurals) which protect the terminal part of the notochord in the Clupeidæ and many of the more generalized Teleosts, but has been used to designate the continuous styliform bony investment of the end of the notochord in *Gastrosteus* and in some other fishes. A comparative study leaves no room for doubt that in many cases the urostyle is merely the result of ankylosis of the uroneurals and that centra take little or no part in its formation, and I do not think that there are any fishes in which a urostyle has been formed simply by ankylosis of posterior centra; but that is a matter which requires further investigation. However, there can be no question that in the Clupeidæ there is no urostyle and that the bones so named by Mr. Whitehouse are not derived from centra, but are the anterior of a series of three pairs of bones, the uroneurals, which may be regarded as neural arches pertaining to posterior centra which have aborted.